Claims:

1. An automobile communications method for an on-board mobile station in a plurality of radio zones which are consecutively arranged along a road, comprising the steps of:

providing each of the radio zones with a plurality of predetermined communication frequencies;

controlling a communication frequency used in each of the radio zones in time division scheme such that simultaneous transmission at a same communication frequency is not permitted in adjoining radio zones and different time slots are allocated for communications at a same communication frequency in adjoining radio zones; and

switching a time slot allocated to the on-board mobile station to continuously communicate with the on-board mobile station over the radio zones.

2. The automobile communication method according to claim 1, wherein the time slot used for communication with the on-board mobile station is switched in such a manner that communication with the on-board mobile station is continuously performed at a same communication frequency over the radio zones.

3. The automobile communication method according to claim 1, wherein the time slot is switched in such a manner that communication with the on-board mobile station is continuously performed at different communication frequencies over the radio zones.

4. An automobile communications method between an on-board mobile station and a fixed station system in a plurality of radio zones which are consecutively arranged along a road, comprising the steps of:

providing each of the radio zones with a plurality of predetermined communication frequencies;

controlling a communication frequency used in each of the radio zones in time division scheme such that simultaneous transmission at a same communication frequency is not permitted in adjoining radio zones and different time slots are allocated for communications at a same communication frequency in adjoining radio zones; and

continuously communicating with the on-board mobile station at a same communication frequency over the radio zones.

5. The automobile communication method according to claim 4, wherein the plurality of predetermined

communication frequencies in each radio zone are generated from a single reference frequency in accordance with a predetermined conversion to be in a frequency-coherence state.

6. The automobile communication method according to claim 4, wherein a predetermined number N (N is an integer equal to or greater than 2) of time slots are determined in one period in each of the radio zones, wherein one time slot is assigned to a single on-board mobile station and M (M is an integer equal to or greater than 2) predetermined communication frequencies are sequentially switched from one to another at a timing of every N/M time slot.

7. The automobile communication method according to claim 6, wherein the time slot allocated to the on-board mobile station is switched in such a way that the on-board mobile station uses a same communication frequency over the plurality of radio zones.

8. The automobile communication method according to claim 4, wherein each of the predetermined communication frequencies is used for both transmission and reception to perform communication with the on-board mobile station according to TDMA/TDD (Time Division Multiple Access/Time

Division Duplex) scheme.

9. The automobile communication method according to claim 4, wherein the plurality of predetermined communication frequencies in each radio zone are generated from a single reference frequency in accordance with a predetermined conversion to be in a frequency-coherence state, wherein each of the predetermined communication frequencies is used for both transmission and reception to perform communication with the on-board mobile station according to TDMA/TDD (Time Division Multiple Access/Time Division Duplex) scheme.

10. The automobile communication method according to claim 4, wherein the plurality of predetermined communication frequencies comprises a plurality of different pairs of first frequencies and second frequencies, wherein the first frequencies are generated from one reference frequency in accordance with a first predetermined conversion so that the first frequencies are in a frequency-coherence state over the radio zones.

11. The automobile communication method according to claim 10, wherein the on-board mobile station generates a transmission local signal of the second frequency from a

radio signal received from the fixed station system in accordance with a second predetermined conversion.

12. The automobile communication method according to claim 11, wherein the fixed station system generates a reception local frequency from the first frequency in accordance with the second predetermined conversion as used by the on-board mobile station so that the reception local frequency and a radio signal received from the on-board mobile station are in a frequency-coherence state.

13. An automobile communications system comprising:

an on-board mobile station movable on a road;

a plurality of fixed stations forming a plurality of radio zones consecutively arranged on the road, respectively, wherein the fixed stations are communicable with the on-board mobile station using one of a plurality of predetermined communication frequencies; and

a control station controlling communication frequencies used by the plurality of fixed stations at predetermined timing in such a way as not to permit simultaneous transmission at a same communication frequency in adjoining radio zones,

the plurality of fixed stations performing continuous communication with the on-board mobile station

by allocating different time slots to communications at a same frequency in adjoining radio zones and switching a time slot allocated to the on-board mobile station.

14. The automobile communication system according to claim 13, wherein the time slot allocated to the on-board mobile station is switched from one to another in such a manner that communication with the on-board mobile station is continuously performed at a same communication frequency over the radio zones.

15. The automobile communication system according to claim 13, wherein each of the plurality of fixed stations comprises:

a frequency generator for generating the plurality of predetermined communication frequencies from a signal of a reference frequency inputting from the control station;

a selector for selecting one communication frequency in use from the plurality of predetermined communication frequencies under control of the control station;

a time-division controller for allocating a time slot to communication with the on-board mobile station at the communication frequency in use; and

an interface for transmission and reception of signals to and from the control station.

16. The automobile communication system according to claim 15, wherein each of the predetermined communication frequencies is used for both transmission and reception to perform communication with the on-board mobile station according to TDMA/TDD (Time Division Multiple Access/Time Division Duplex) scheme.

17. The automobile communication system according to claim 15, wherein the frequency generator generates the plurality of predetermined communication frequencies so that the predetermined communication frequencies are frequency-coherent to the reference frequency wherein each of the predetermined communication frequencies is used for transmission and reception, and wherein the time-division controller performs communication with the on-board mobile station according to TDMA/TDD (Time Division Multiple Access/Time Division Duplex) scheme.

18. The automobile communication system according to claim 15, wherein the plurality of predetermined communication frequencies comprises a plurality of different pairs of first frequencies and second frequencies.

wherein the frequency generator generates the first frequencies from one reference frequency in accordance with a first predetermined conversion so that the first frequencies are in a frequency-coherence state.

19. The automobile communication method according to claim 18, wherein each of the fixed stations generates a reception local frequency from the first frequency in accordance with a second predetermined conversion as used by the on-board mobile station so that the reception local frequency and a radio signal received from the on-board mobile station are in a frequency-coherence state.

20. The automobile communication system according to claim 13, wherein the on-board mobile station comprises:

frequency-in-use regenerator for regenerating the communication frequency in use from a signal received from a fixed station which forms a radio zone for communication; and

a communication controller controlling communication with the fixed station using the allocated time slot at the communication frequency in use.

21. The automobile communication system according to claim 20, wherein each of the plurality of predetermined

communication frequencies is used for transmission and reception, and the communication controller carries out communication with the fixed station according to a TDMA/TDD scheme.

22. The automobile communication system according to claim 20, wherein each of said plurality of predetermined communication frequencies is used for transmission and reception frequencies,

wherein the frequency-in-use regenerator comprises:

a demodulator for demodulating the received signal, and

a phase controller for performing phase control on a signal of an oscillation frequency based on an output of the demodulator such that the demodulator acquires synchronization; and

wherein the communication controller carries out communication with the fixed station according to a TDMA/TDD scheme using the oscillation frequency as a transmission local frequency.

23. The automobile communication system according to claim 20, wherein the frequency-in-use regenerator comprises:

a demodulator for demodulating the received signal using an oscillation frequency, and

a phase controller for performing phase control on the signal of the oscillation frequency based on an output of the demodulator such that the demodulator acquires synchronization; and

wherein the on-board mobile station further comprises:

a converter for generating a transmission local frequency from the signal of the oscillation frequency in accordance with a predetermined conversion, and

a modulator for generating a transmission signal using the transmission local frequency.

24. The automobile communication system according to claim 23, wherein the predetermined conversion of the converter is the same as a predetermined conversion for generating a reception local signal from a transmission frequency at each fixed station.

25. A fixed station in the automobile communication system as recited in claim 13, comprising:

a communication frequency generator for generating the plurality of predetermined communication frequencies from a signal of a reference frequency coming

from the control station;

a selector for selecting one communication frequency in use from the plurality of predetermined communication frequencies under control of the control station;

a time-division controller for allocating a time slot to communication with the on-board mobile station at the communication frequency in use; and

an interface for implementing transmission and reception of signals to and from the control station.

26. The fixed station according to claim 25, wherein each of the plurality of predetermined communication frequencies is used for transmission and reception, and communication with the on-board mobile station is carried out according to a TDMA/TDD scheme.

27. The fixed station according to claim 25, wherein each of the plurality of predetermined communication frequencies is used for transmission and reception, the communication frequency generator generates the plurality of predetermined communication frequencies in each radio zone so that the predetermined communication frequencies are frequency-coherent to the reference frequency, and the time-division controller carries out communication with the

on-board mobile station according to a TDMA/TDD scheme.

28. The fixed station according to claim 25, wherein the plurality of predetermined communication frequencies comprises a plurality of different pairs of a first frequency and a second frequency, and the communication frequency generator generates the first frequency from the reference frequency in accordance with a first predetermined conversion in such a manner that those first frequencies are in a frequency-coherence state over the plurality of radio zones.

29. The fixed station according to claim 25 ~~or 28~~, wherein the plurality of predetermined communication frequencies comprises a plurality of different pairs of a first frequency and a second frequency, and a reception local frequency for demodulating a received radio signal from the on-board mobile station is generated from the first frequency in accordance with a second predetermined conversion so that the reception local signal is frequency-coherent to the received radio signal from the on-board mobile station.

30. An on-board radio mobile station in the automobile communication system as recited in claim 13,

comprising:

a frequency-in-use regenerator for regenerating the communication frequency in use from a signal received from a fixed station which forms a radio zone for communication; and

a communication controller for communicating with the fixed station using the allocated time slot based on the communication frequency in use.

31. The on-board radio mobile station according to claim 30, wherein each of the plurality of predetermined communication frequencies is used for transmission and reception, and the communication controller carries out communication with the fixed station according to a TDMA/TDD scheme.

32. The on-board radio mobile station according to claim 30, wherein each of the plurality of predetermined communication frequencies is used for transmission and reception;

wherein the frequency-in-use regenerator comprises:

a demodulator for demodulating the received signal, and

a phase controller performing phase control on a

signal of an oscillation frequency based on an output of the demodulator such that the demodulator acquires synchronization; and

wherein the communication controller carries out communication with the fixed station according to a TDMA/TDD scheme by using the oscillation frequency as a transmission local frequency.

33. The on-board radio mobile station according to claim 30, wherein the frequency-in-use regenerator comprises:

a demodulator for demodulating a received signal of an oscillation frequency, and

a phase controller performing phase control on the signal of the oscillation frequency based on an output of the demodulator such that the demodulator acquires synchronization: and

wherein the on-board radio mobile station further comprises:

a converter for generating a transmission local frequency from the signal of the oscillation frequency in accordance with a predetermined conversion, and

a modulator for generating a transmission signal using the transmission local frequency.

34. The on-board radio mobile station according to claim 30, wherein the predetermined conversion of the converter is the same as a predetermined conversion for generating a reception local signal from a transmission frequency at each fixed station.

35. A control station in the automobile communication system as recited in claim 13, comprising:

a reference frequency generator for generating a reference frequency signal for producing the plurality of predetermined communication frequencies in each fixed station;

a communication controller for transmitting and receiving signals to and from the plurality of fixed stations; and

a system controller controlling communication frequencies in use by the plurality of fixed stations at predetermined timing in such a way as not to permit simultaneous transmission at a same communication frequency in adjoining radio zones.

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